Qualitative Analysis by Anion Exchange Resin

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recorder as manufactured by Shimazu Seisakusho Ltd., Kyoto. It can easilly be transformed into a surface temperature self recorder by attaching a simple device to it.

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12. Qualitative Analysis by Anion Exchange Resin

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Ion exchange resin can be employed to prepare pure lyophobic sols or precipitates from solution. The authors applied anion exchange resins of various forms to separate cations into the groups of qualitative analysis by the precipitation method.

Amberlite IRA-400 or 410 was changed to chloride-, sulfide-, hydroxide-, and carbonate-ion exchangers and about 10 cc of them packed in columns. The sample solutions, whose concentrations were 0.01 to 0.1 N, were passed through these columns and washed by water of 10 times the volume of the original. The filtrate contained the precipitates corresponding to the form of exchangers. The precipitates were analysed as usual. The outline of this method is shown in Table 1.

The sample solution was passed through a chloride-ion exchanger. All of Ag ion was precipitated and Pb, Bi, Sb, and Sn ions were partially precipitated when they were present. Every anion contained in the original sample solution changed to chloride ion and the precipitates could be formed without interferences of anions.

The filtrate from these precipitates of Group I was passed through a sulfide-ion exchanger. All ions of Groups II and III except Al and Cr ions were precipitated as sulfides by this procedure. As these precipitates were very fine, Group III was readily dissolved in 0.3 N HCl. The acidic solution containing sulfides of Group II was heated to boil to coagulate the precipitates and to concentrate the solution. After filtration, the precipitates were separated into the two sub-groups as usual.

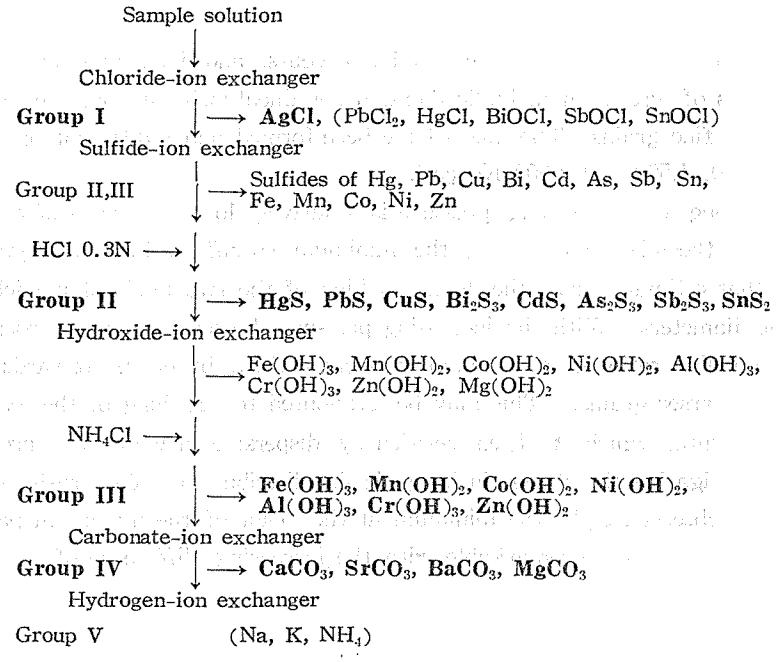
The sulfide-ion exchanger applied to this procedure was generated with yellow ammonium sulfide. It seemed that the resin adsorbed only sulfide ion, because all ions of Sn-Group were precipitated by the exchange.

The filtrate from Group II was passed through a hydroxide-ion exchanger. All of the ions of Group III were precipitated as hydroxides. When Mg ion was present, it also precipitated as $Mg(OH)_2$. Then this solution containing the precipitates were added ammonium chloride to dissolve $Mg(OH)_2$. The precipitates were filtered and these hydroxides could be analysed as usual without changing to sulfides, because all ions of Group III had been precipitated. Some of Al ion seems to be adsorbed in the resin.

The filtrate from Group III was passed through a carbonate-ion exchanger to precipitate ions of Group IV. The precipitates were analysed as usual. The carbonate-ion exchange resin was generated with ammonium carbonate.

The filtrate from Group IV containing Group V was adsorbed by a hydrogen-ion exchange resin and subsequently eluted by hydrochloric acid of various concentration to separate each ion.

Table 1. The outline of the grouping of ions by anion exchange resins.



The separation of ions into the groups will also be able to perform under equilibrium conditions. That is, the sample solution is treated with resins in beaker. By this method Group II is precipitated in 0.3 N hydrochloric acid without interference by Group III. And Group III is precipitated as hydroxide with ammonium chloride without precipitation of $Mg(OH)_2$. But the resin is preferable to be regenerated in column.

In conclusion, the precipitates of ions of every group were formed by anion exchange resins of various forms. Especially this method using anion exchangers can serve to eliminate the use of hydrogen sulfide.